CLAIMS:

1. A living body optical measurement system comprising:

a plurality of light irradiation means for irradiating light rays having the wavelength range of from visible rays to near infrared rays on a subject;

a plurality of light receiving means for detecting light rays irradiated from said light irradiation means and transmitting through the interior of said subject;

memory means for storing, in time sequence, signals detected by said light receiving means and delivered out of the respective ones of said plurality of light receiving means;

arithmetic means for performing conversion into signals of objects to be measured at a plurality of presumptive measuring points by using the signals stored in said memory means; and

image preparation means for displaying the output of said arithmetic means as an image representative of an intensity signal on a two-dimensional display screen by calculating and determining signals at positions of the presumptive measuring points through an arithmetic operation.

2. A living body optical measurement system according to claim 1, wherein each of said plurality of light irradiation means includes a plurality of light sources having different wavelengths, modulators for

modulating the light rays of said plurality of light sources with different frequencies and wave guide means for guiding a plurality of modulated light rays to light irradiation positions, and each of said plurality of light receiving means includes split means for separating the intensity levels of the light rays from said plurality of light sources having the different wavelengths.

3. A living body optical measurement system according to claim 2, wherein said separation means is comprised of lock-in amplifiers driven by modulation signals of said modulators.

4. A living body optical measurement system according to claim 1, wherein the number of said plurality of light sources having different wavelengths equals the number of kinds of light absorbers to be measured.

5. An imaging method comprising the steps of:

irradiating light rays having the wavelength range of from visible rays to near infrared rays on a plurality of light irradiation positions of a subject;

detecting light rays transmitting through the interior of said subject at at least one light detection point associated with each of said plurality of light irradiation positions;

calculating signals at presumptive measuring points from said plurality of light irradiation positions;

determining concentration values of light absorbers included in the interior of said subject; and

displaying concentration values of light absorbers at the plurality of presumptive measuring points obtained in the above step as a two-dimensional plane image representative of said subject.

6. An imaging method according to claim 5, wherein in the first step, said measuring point is an arbitrary position on a perpendicular vertical to the surface of said subject and extending to the interior of said subject from an intermediate point between said light irradiation position and light detection position, and in the second step, light absorber concentration values obtained at said plurality of measuring points and interpolated light absorber concentration values obtained by interpolating the light absorber concentration values obtained at said plurality of measuring points between the respective measuring points are displayed as a topography image.

7. An imaging method according to claim 5 or 6, wherein an image is obtained by using as said light absorber concentration value a light absorber concentration value at a desired time point or a value obtained by averaging amounts of changes in light absorber concentration values over a predetermined interval of time.

8. An imaging method according to claim 5 or 6, wherein in the second step, light absorber concentra-

tion values or amounts of changes in light absorber concentration values are determined at desired intervals of time to obtain a time-variable image which is continuous over the respective intervals of time.

9. An imaging method according to claim 6, wherein in the second step, image information about the interior of a subject measured using magnetic resonance and X-rays is displayed together with information about said light absorber concentration while being superimposed upon said two-dimensional image on the same screen.

10. An imaging method according to claim 5 or 6, wherein in the second step, light absorber concentration values or amounts of changes in light absorber concentration values are determined at desired intervals of time, a time-variable change in said change amounts measured at one desired measuring point is used as a reference to determine the correlation of a time-variable change in said change amounts at another measuring point to the reference, thereby obtaining a time-varying image of a correlation function which is continuous over the respective intervals of time.

11. A living body optical measurement method for measuring the living body transmitting light intensity by irradiating light on a living body while alternately setting loading time during which load is applied to the living body and unloading time during which load is

not applied to the living body, wherein relaxation time following the loading time is set, and a signal corresponding to fluctuation attributable to the living body and contained in the measured signal is estimated from a measured signal obtained during the unloading time exclusive of the relaxation time.

12. A living body optical measurement method according to claim 11, wherein load preceding estimation time which immediately precedes each loading time is set, load succeeding estimation time which immediately succeeds each relaxation time is set, and a signal corresponding to fluctuation attributable to the living body and contained in the measured signal is estimated for each loading time from a measured signal obtained during the loading preceding estimation time and a measured signal obtained during the loading succeeding estimation time.

13. A living body optical measurement method according to claim 11 or 12, wherein an arbitrary function having a single or a plurality of indefinite coefficients is set, said indefinite coefficients are determined through the method of least squares such that said arbitrary function is optimally adaptive to a measured signal obtained during the unloading time exclusive of the relaxation time, and the thus determined optimal adaptive function is made to be a signal corresponding to the fluctuation attributable to the living body.

14. A living body optical measurement method according to claim 11 or 12, wherein the difference between the measured signal and the signal corresponding to the fluctuation attributable to the living body is calculated.

15. A living body optical measurement method according to claim 10 or 11, wherein by using a ratio between the estimated signal corresponding to the fluctuation attributable to the living body and the measured signal, a extinction coefficient to a light source wavelength of hemoglobin oxide and a extinction coefficient to the light source wavelength of reduced hemoglobin, a relative change amount of the sum of concentration values of hemoglobin oxide and reduced hemoglobin in the living body, a relative change amount of concentration of hemoglobin oxide, a relative change amount of concentration of reduced hemoglobin, a time-variable change in each of the relative change amounts, an integral relative change amount obtained by integrating each of the relative change amounts over a predetermined interval of time, or an averaged relative change amount over a predetermined interval of time is calculated.

16. A signal display method in a living body optical measurement system in which the living body transmitting light intensity is measured by irradiating light on a living body and a measured signal or a signal resulting from calculation of the measured

signal is displayed on a display unit, wherein a signal corresponding to fluctuation attributable to the living body and contained in the measured signal is estimated and the estimated signal is displayed together with the measured signal.

17. A signal display method in a living body optical measurement system in which the living body transmitting light intensity is measured by irradiating light on a living body while alternately setting loading time during which load is applied on the living body and unloading time during which load is not applied to the living body, and a measured signal or a signal calculated from the measured signal is displayed on a display unit, wherein a signal corresponding to fluctuation attributable to the living body and contained in the measured signal is estimated from a measured signal obtained during the unloading time, and the estimated signal, together with the measured signal, is displayed as an estimation non-load signal.

18. A signal display method in a living body optical measurement system in which the living body transmitting light intensity is measured by irradiating light on a living body while alternately setting loading time during which load is applied to the living body and unloading time during which load is not applied to the living body, and a measured signal or a signal calculated from the measured signal is displayed on a display unit, wherein relaxation time following

the loading time is set, a signal corresponding to fluctuation attributable to the living body and contained in the measured signal is estimated from a measured signal obtained during the unloading time exclusive of the relaxation time, and the estimated signal, together with the measured signal, is displayed as an estimation non-load signal.

19. A signal display method in a living body optical measurement system according to claim 18, wherein load preceding estimation time which immediately precedes each loading time is set, load succeeding estimation time which immediately succeeds each relaxation time is set, and said estimation non-load signal is determined for each loading time from a measured signal obtained during the loading preceding estimation time and a measured signal obtained during the loading succeeding estimation time.

20. A signal display method in a living body optical measurement system according to claim 17, 18 or 19, wherein an arbitrary function having a single or a plurality of indefinite coefficients is set, said indefinite coefficients are determined through the method of least squares such that said arbitrary function is optimally adaptive to a measured signal obtained during the unloading time exclusive of the relaxation time, and the thus determined optimal adaptive function is made to be a signal corresponding to fluctuation attributable to the living body.

21. A signal display method in a living body optical measurement system according to any one of claims 17 to 19, wherein the difference between the measured signal and the estimation non-load signal is calculated and a result of calculation is displayed.

22. A signal display method in a living body optical measurement system according to any one of claims 17 to 19, wherein by using a ratio between the estimation non-load signal and the measured signal, an extinction coefficient to a light source wavelength of hemoglobin oxide and an extinction coefficient to the light source wavelength of reduced hemoglobin, a relative change amount of the sum of concentration values of hemoglobin oxide and reduced hemoglobin in the living body, a relative change amount of concentration of hemoglobin oxide, a relative change amount of concentration of reduced hemoglobin, a time-variable change in each of the relative change amounts, an integral relative change amount obtained by integrating each of the relative change amounts over a predetermined interval of time, or an averaged relative change amount over a predetermined interval of time is calculated.

23. A signal display method in a living body optical measurement system according to any one of claims 16 to 19, wherein different signals or different calculation results are displayed using different colors or different kinds of lines.

24. A signal display method in a living body optical measurement system according to any one of claims 17 to 19, wherein concurrent display of figures illustrative of start and end times of the loading time is effected.

25. A signal display method in a living body optical measurement system according to any one of claims 17 to 19, wherein the measured signal is displayed concurrently with measurement on real time base, and the estimation non-load signal is displayed until a time point exceeding the time for measurement displayed.

26. A signal display method in a living body optical measurement system according to any one of claims 16 to 19, wherein a plurality of signals at a plurality of measuring positions are displayed together with a figure illustrative of a measuring portion of the living body, a figure illustrative of measuring positions, and a figure designating the correspondence between the measuring positions and the signals.

27. A signal display method in a living body optical measurement system according to any one of claims 17 to 19, wherein an image taken by an image diagnostic system is used as the figure illustrative of measuring positions.

28. A living body optical measurement system comprising light irradiation means for irradiating light on the surface of a living body and light

detecting means for detecting the intensity of light transmitting through the interior of the living body and going out of the surface of the living body, wherein at least two sets of combination of light irradiation and light detection positions are provided, and a logarithmic difference signal between detection signals for the respective sets is used as a measured signal.

29. A living body optical measurement system according to claim 28 comprising at least two sets of combination of light irradiation and light detection positions, the distance between the light irradiation and light detection positions being equal for each set.

30. A living body optical measurement system according to claim 28 or 29 comprising a logarithmic amplifier and a differential amplifier, wherein the light detection signal is logarithmically amplified and then a logarithmic difference signal is generated by the differential amplifier.

31. A living body optical measurement system according to claim 28 or 29, wherein said light irradiation means includes an optical fiber for connecting the light source and the light irradiation position, and said light detection means includes an optical fiber for connecting a photodetector and the light detection position.

32. A living body optical measurement system according to claim 29 comprising a light detection

probe unit for fixing an optical fiber end of said light irradiation means and an optical fiber end of said light detection means, and an optical measuring unit including an electric signal processing circuit comprised of a light source of said light irradiation means and a photodetector of said light receiving means.

33. A living body optical measurement system according to claim 28 or 29 comprising a light irradiation position, a first detection position, a second detection position, a third detection position set on a half line extending from its origin at the light irradiation position to pass through the first detection position, and a fourth detection position set on a half line extending from its origin at the light irradiation position to pass through the second detection position, wherein a logarithmic difference signal (first logarithmic difference signal) between light detection signals detected at said first and third detection positions and a logarithmic difference signal (second logarithmic difference signal) between transmitting light intensity levels detected at said second and fourth detection positions are measured, and a difference signal between said first and second logarithmic difference signals is measured.

34. A living body optical measurement system according to claim 28 or 29 comprising:

first light irradiation means for irradiating

light on the surface of the living body;

first irradiation light intensity detection means for detecting the irradiation light intensity from said first light irradiation means;

second light irradiation means for irradiating light on the surface of the living body;

second irradiation light intensity detection means for detecting the irradiation light intensity from said second light irradiation means;

light detection means for detecting the intensity of light attributable to said first light irradiation means or said second light irradiation means and transmitting through the interior of the living body so as to go out of the surface of the living body;

means for generating a logarithmic difference signal (first logarithmic difference signal) between an output of said first irradiation light intensity detection means and an output of said light detection means attributable to said first light irradiation means;

means for generating a logarithmic difference signal (second logarithmic difference signal) between an output of said second irradiation light intensity detection means and an output of said light detection means attributable to said second light irradiation means; and

means for measuring a difference signal

between said first and second logarithmic difference signals.

35. A living body optical measurement system according to claim 28 or 29, wherein irradiation light from said light irradiation means is modulated in intensity, and only a frequency component of the detection signal from said light detection means which equals a frequency for the intensity modulation is extracted for use by a lock-in amplifier or through a Fourier transform processing.

36. A living body optical measurement system according to claim 28 or 29, wherein the number m of wavelengths of irradiation light equals the number n of light irradiation positions, and n × m kinds of intensity modulation frequencies for the light source are used.

37. A living body optical measurement method using the living body optical measurement system as recited in claim 28 or 29, wherein measurement is carried out by setting the light irradiation position and the light detection positions on the surface of the living body such that a signal from a region where extinction characteristics changes locally on the basis of a change in hemodynamic movement in the living body is contained in a light intensity signal detected at at least one light detection position but is not contained in a light intensity signal detected at at least another light detection position.

38. A living body optical measurement method according to claim 28 or 29, wherein after a logarithmic difference signal between different sites of detection position is so adjusted as to be zero under the condition that the change does not occur at the region where extinction characteristics changes locally in the living body, measurement is started and a displacement value of the difference signal is used as the measured signal.